

WHAT IS CLAIMED IS:

1. An isolated fusion molecule comprising a first polypeptide sequence capable of specific binding to a native IgG inhibitory receptor comprising an immune receptor tyrosine-based inhibitory motif (ITIM), functionally connected to a second polypeptide sequence capable of specific binding, through a third polypeptide sequence, to a native IgE receptor (FcεR), wherein said first and second polypeptide sequences are other than antibody variable region sequences and wherein said fusion molecule is not capable of T cell interaction prior to internalization.

2. The fusion molecule of claim 1 wherein said second polypeptide sequence comprises an antigen sequence.

3. The fusion molecule of claim 2 wherein said antigen sequence is at least a portion of an autoantigen sequence.

4. The fusion molecule of claim 3 wherein said the autoantigen sequence comprises at least one autoantigenic epitope.

5. The fusion molecule of claim 3, wherein said third polypeptide is an immunoglobulin specific for said autoantigen sequence.

6. The fusion molecule of claim 5, wherein said immunoglobulin specific for said autoantigen sequence is an IgE class antibody.

7. The fusion molecule of claim 3 wherein said autoantigen sequence is selected from the group consisting of rheumatoid arthritis autoantigen, multiple sclerosis autoantigen, autoimmune type I diabetes mellitus autoantigen, and portions thereof.

8. The fusion molecule of claim 7 wherein said autoantigen is selected from the group consisting of myelin basic protein (MBP), proteolipid protein, myelin oligodendrocyte glycoprotein, αβ-crystallin, myelin-associated glycoprotein, Po glycoprotein, PMP22, 2',3'-cyclic nucleotide 3'-

phosphohydrolase (CNPase), glutamic acid decarboxylase (GAD), insulin, 64 kD islet cell antigen (IA-2, also termed ICA512), phogrin (IA-2 β), type II collagen, human cartilage gp39 (HCgp39), and gp130-RAPS.

5 9. The fusion molecule of claim 3 wherein said autoantigen sequence present in said fusion molecule has at least 90% sequence identity with at least a portion of a native autoantigen sequence.

10 10. The fusion molecule of claim 3 wherein said autoantigen sequence present in said fusion molecule is encoded by a nucleic acid hybridizing under stringent conditions to the complement of a nucleic acid molecule encoding a native autoantigen.

15 11. The fusion molecule of claim 3 wherein said inhibitory receptor is a low-affinity Fc γ RIIb IgG receptor.

 12. The fusion molecule of claim 11 wherein said IgE receptor is a high-affinity Fc ϵ RI IgE receptor.

20 13. The fusion molecule of claim 11 wherein said IgE receptor is a low-affinity Fc ϵ RII (CD23) IgE receptor.

 14. The fusion molecule of claim 12 wherein said Fc γ RIIb and Fc ϵ RI receptors are of human origin.

25 15. The fusion molecule of claim 14 wherein said first polypeptide sequence comprises an amino acid sequence having at least 85% identity with a native human IgG heavy chain constant region sequence.

30 16. The fusion molecule of claim 15 wherein said IgG is selected from the group consisting of IgG₁, IgG₂, IgG₃, and IgG₄.

17. The fusion molecule of claim 15 wherein said native human IgG heavy chain constant region sequence is the native human IgG heavy chain constant region sequence of SEQ ID NO: 2.

18. The fusion molecule of claim 17 wherein said first polypeptide sequence comprises an amino acid sequence having at least 85% identity to the amino acid sequence of SEQ ID NO: 3.

19. The fusion molecule of claim 18 wherein said first polypeptide sequence comprises an amino acid sequence having at least 90% identity to the amino acid sequence of SEQ ID NO: 3.

20. The fusion molecule of claim 19 wherein said first polypeptide sequence comprises an amino acid sequence having at least 95% identity to the amino acid sequence of SEQ ID NO: 3.

21. The fusion molecule of claim 20 wherein said first polypeptide sequence comprises an amino acid sequence having at least 98% identity to the amino acid sequence of SEQ ID NO: 3.

22. The fusion molecule of claim 21 wherein said first polypeptide sequence comprises at least part of the CH2 and CH3 domains of a native human IgG₁ constant region.

23. The fusion molecule of claim 22 wherein said first polypeptide sequence additionally comprises at least part of the hinge of a native human IgG₁ constant region.

24. The fusion molecule of claim 23 wherein said first polypeptide sequence comprises at least part of the hinge, CH2 and CH3 domains of a native human IgG₁ heavy chain constant region, in the absence of a functional CH1 region.

25. The fusion molecule of claim 1 wherein said first polypeptide sequence comprises an amino acid sequence encoded by a nucleic acid hybridizing under stringent conditions to at least a portion of the complement of the IgG heavy chain constant region nucleotide sequence of SEQ ID NO: 1.

26. The fusion molecule of claim 3 wherein said first and second polypeptide sequences are functionally connected through a linker.

27. The fusion molecule of claim 26 wherein said linker is a polypeptide linker.

28. The method of claim 27 wherein said polypeptide linker sequence consists of about 5 to about 25 amino acid residues.

29. The method of claim 1, wherein said fusion molecule comprises at least one amino-terminal ubiquitination target motif.

30. The method of claim 1, wherein said fusion molecule comprises at least one proteasome proteolysis signal, wherein said signal is selected from the group consisting of large hydrophobic amino acid residues, basic amino acid residues and acidic amino acid residues.

31. The method of claim 27, wherein said polypeptide linker comprises at least one proteasome proteolysis signal, wherein said signal is selected from the group consisting of large hydrophobic amino acid residues, basic amino acid residues and acidic amino acid residues.

32. The method of claim 27 wherein said polypeptide linker sequence comprises at least one endopeptidase recognition motif.

33. The method of claim 27 wherein said polypeptide linker sequence comprises a plurality of endopeptidase recognition motifs.

34. The method of claim 32 wherein said endopeptidase recognition motif is selected from the group consisting of cysteine, aspartate and asparagine amino acid residues.

35. An isolated nucleic acid molecule encoding a fusion molecule of claim 1.

36. An isolated nucleic acid molecule encoding a fusion molecule of claim 3.

37. A vector comprising and capable of expressing a polypeptide encoded by a nucleic acid molecule of claim 35.

5 38. A host cell transformed with the nucleic acid molecule of claim 35.

39. A host cell transformed with the nucleic acid molecule of claim 36.

10 40. A pharmaceutical composition comprising a fusion molecule of claim 1 in admixture with a pharmaceutically acceptable excipient.

41. A pharmaceutical composition comprising a fusion molecule of claim 3 in admixture with a pharmaceutically acceptable ingredient.

15 42. An article of manufacture comprising a container, a fusion molecule of claim 1 within the container, and a label or package insert on or associated with the container.

20 43. An article of manufacture comprising a container, a fusion molecule of claim 3 within the container, and a label or package insert on or associated with the container.

44. The article of manufacture of claim 42 wherein said label or package insert comprises instructions for the treatment or prevention of an immune disease.

25 45. A method for the treatment of an autoimmune disease in a subject, comprising administering an effective amount of at least one fusion molecule of claim 3 to said subject diagnosed with or at risk of developing said autoimmune disease.

46. The method of claim 45 comprising multiple administration.

30 47. The method of claim 45 wherein said subject is a human.

48. The method of claim 45 wherein said autoimmune disease is selected from the group consisting of rheumatoid arthritis, type-I diabetes mellitus, and multiple sclerosis.

49. The method of claim 48 wherein said autoantigen is selected from the group consisting of rheumatoid arthritis autoantigen, multiple sclerosis autoantigen, autoimmune type I diabetes mellitus autoantigen, and portions thereof.

50. The method of claim 49 wherein said autoantigen is selected from the group consisting of myelin basic protein (MBP), proteolipid protein, myelin oligodendrocyte glycoprotein, $\alpha\beta$ -crystallin, myelin-associated glycoprotein, Po glycoprotein, PMP22, 2',3'-cyclic nucleotide 3'-phosphohydrolase (CNPase), glutamic acid decarboxylase (GAD), insulin, 64 kD islet cell antigen (IA-2, also termed ICA512), phogrin (IA-2 β), type II collagen, human cartilage gp39 (HCgp39), and gp130-RAPS.

51. A method for the prevention of symptoms resulting from a type I hypersensitivity reaction in a subject receiving immunotherapy, comprising administering at least one fusion molecule to said subject, wherein said fusion molecule comprises a first polypeptide sequence capable of specific binding to a native IgG inhibitory receptor comprising an immune receptor tyrosine-based inhibitory motif (ITIM), functionally connected to a second polypeptide sequence capable of binding directly, or indirectly through a third polypeptide sequence, to a native IgE receptor (Fc ϵ R), wherein said first and second polypeptide sequences are other than antibody variable region sequences and wherein said fusion molecule is not capable of T cell interaction prior to internalization, wherein said second polypeptide comprises a sequence selected from the group consisting of:

- a) at least a portion of an autoantigen,
- b) an allergen, and
- c) at least a portion of an IgE immunoglobulin heavy chain constant region capable of binding to a native IgE receptor (Fc ϵ R).

52. The method of claim 51, wherein said symptoms resulting from a type I hypersensitivity reaction comprise an anaphylactic response.

53. The method of claim 51 wherein said first polypeptide comprises at least a portion of an IgG immunoglobulin heavy chain constant region.

5 54. The method of claim 51, wherein said third polypeptide is an IgE class antibody.

55. The method of claim 51, wherein said subject receiving immunotherapy is being treated for a disease selected from type I hypersensitivity-mediated disease and autoimmune disease.

10 56. The method of claim 51, wherein said fusion molecule is administered to said subject prior to said subject receiving immunotherapy.

15 57. The method of claim 51, wherein said fusion molecule is co-administered to said subject with said immunotherapy.

58. The method of claim 51, wherein said fusion molecule is administered after said subject receives immunotherapy.

20 59. A method for the prevention of a type I hypersensitivity disease in a subject receiving immunotherapy, comprising administering at least one fusion molecule to said subject, wherein said fusion molecule comprises a first polypeptide sequence capable of specific binding to a native IgG inhibitory receptor comprising an immune receptor tyrosine-based inhibitory motif (ITIM), functionally connected to a second polypeptide sequence capable of binding directly, or indirectly through a third polypeptide sequence, to a native IgE receptor (FcεR), wherein said first and second polypeptide sequences are other than antibody variable region sequences and wherein said fusion molecule is not capable of T cell interaction prior to internalization, and wherein said second polypeptide comprises a sequence selected from the group consisting of:

- 25
- a) at least a portion of an autoantigen,
 - b) an allergen, and
 - 30 c) at least a portion of an IgE immunoglobulin heavy chain constant region capable of binding to a native IgE receptor (FcεR).